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STATUS OF THE MOUNTAIN PINE BEETLE IN MARIPOSA GROVE AND RECOMMENDATIONS FOR CONTROL

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INTRODUCTION

Insect losses, principally to sugar pine and ponderosa pine within the Mariposa Grove area have continued heavy during the past 7 years, even though considerable time and effort have been expended by the National Park Service in an attempt to control the insects. Control work was begun during 1932, following heavy losses previously unknown to this area. Since then, each year control by CCC enrollees has been maintained for the specific purpose of keeping ahead of the mountain pine beetle, particularly in the magnificent sugar pines which are considered second only to the Giant Sequoias as a public attraction to this area.

The reasons for the apparent failure of such work to keep the insects down are not easy to understand. Mariposa Grove occupies a comparatively small area of about 2500 acres and is fairly well isolated from similar areas by mountain barriers and cut over lands. As such it should be comparatively easy to control the infestations.

In attempting to explain the reasons why insects have gained such a foothold, it is necessary to analyze the conditions favorable to their development; whether they are the result of inefficient or faulty control practice or some factor or factors determined as the result of investigative study. Whatever the cause, the pressure of recent infestations brings forcibly to mind the need for more drastic treatment. The purpose of this report is to uncover as many facts as obtainable to act as an aid in mapping out a course of action for the immediate future.

During the period covered by this report, the writer has been engaged in a detailed investigative study of the mountain pine beetle and is personally familiar with the trends and developments in Mariposa Grove. This area has indeed served as a particularly fertile field in which to study, not only the mountain pine beetle, but also many of the factors related definitely to its continued development.

CONTROL WORK ACCOMPLISHED, 1932-1939.

The figures* presented in Table 1 represent the number of trees and volume treated during this period. It was the aim of the Park Service to get all of the trees in the area during a given CCC enrollment period, but often this goal was not attained, hence the actual amount of damage is probably much greater than these figures represent. The initial project

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* These figures were obtained from treating records on file at the Branch of Forestry in Yosemite National Park.

in 1932 was financed by regular insect control funds, while all subsequent control was carried on by CCC enrollees under the direct supervision of the Park Service.

Table I. Number of Trees and Volume Treated, 1932-1939

Date	Sugar Pine		Ponderosa Pine		Method of Treatment
	Trees	Volume	Trees	Volume	
1932, Dec.	116	771,000	29	90,640	Burning
1933, June-Aug.	33	216,840	18	26,530	Peeling and suncuring
1934, Apr.-Sept.	44	140,990	21	94,130	Peeling and suncuring
1934-35, Oct.-Mar.	9	33,670	1	3,120	Burning
1935, Apr.-Sept.	3	15,400	9	21,080	Peeling (windfalls only)
1936, Nov.-Dec.	24	170,940	3	8,690	Burning (incomplete)
1937, Oct.-Dec.	8	42,230	1	7,500	Burning
1938, Jan.-Dec.	0	0	0	0	
1939, May - June	16	70,520	0	0	Peeling
Total for 7 years	253	1,461,590	82	251,690	

The above figures show how, in the face of control work accomplished each year, each succeeding year has yielded still more trees to be treated. The answer is found partly if not wholly in the time of treatment, and failure to treat at other times. There has always been considerable doubt as to whether summer control is very effective, partly because of the variation in brood stages, some of which escape, and partly because of the need for more and closer supervision. Control during the late fall and early spring months on the other hand, is thoroughly effective since during that time burning is possible, wherein the broods are effectively destroyed.

Referring to the table the following inconsistencies are apparent in the administration of the various control jobs.

1. No control was undertaken during the winter of 1933-1934.
2. During the summer of 1935 only windfalls were treated. Broods were allowed to escape from standing trees left untreated.
3. No control work whatever was undertaken during 1938, even though the infestation in the Grove was still going strong. In addition during the winter (1937-1938) windstorms caused heavy damage by breakage and windfalls which served as ideal breeding places. No attempt was made to clean them up.

Other factors not showing in the table which contributed materially to the continued buildup in infestation are known by the writer. The most noteworthy example occurred during the winter of 1936-1937 when early winter storms forced the closing down of operations before all trees were treated. A total number of 24 sugar pines, having a volume of 170,940 board feet were felled, but only a part of this number was treated. The remainder were never again visited.

During 1939 only a portion of the overwintering population was treated late in the spring, by felling and peeling, when emergence of the broods was already under way. The total number of sugar pines killed by the 1938-1939 overwintering generation of mountain pine beetle was 46 trees, while only 16 of this number was treated.

PRESENT LOSSES EXISTING IN THE GROVE

A survey of the Mariposa Grove area was undertaken by the Bureau of Entomology and Plant Quarantine during September, 1939, as a part of the mountain pine beetle study. Table 2 presents the results of this survey and shows definitely that the losses are apparently on the increase again and should be controlled. As shown on the map accompanying this report, the greatest damage is concentrated in the southwest half of the Grove, particularly in the vicinity of the Grizzly Giant, and extends through the upper Grove and in the vicinity of Wawona Point. The survey included all losses caused by the overwintering (1938-1939), summer (1939), and part of the overwintering (1939-1940) generations.

Table 2. Insect Losses in Mariposa Grove (1938-1939)

Season	Number trees	Volume (board feet)	Character of kill
		Sugar Pine	
1938 winter	46	163,620	Entire
1939 summer	47	162,680	Entire
1939 winter	10	56,520	Entire
1939 top-kill	5	54,810	Top-kill (possible overwinter)
		Ponderosa Pine	
1938 winter	12	43,740	Entire
1939 summer	12	73,530	Entire
1938-39 topkill	4	33,730	Topkills (1938 and 1939)
		Jeffrey Pine	
1938 winter	1	2,020	Entire
1939 winter	2	6,570	Entire

These figures show that the combined losses among all three species of trees during the 1939 season amounted to 72 trees having a volume of 301,320 board feet. Of this number, 57 trees having a total volume of 219,200 board feet were sugar pines. The insect responsible for the sugar pine damage was definitely the mountain pine beetle, while the western pine beetle killed the ponderosa pines, and the Jeffrey pine beetle killed the Jeffrey pines.

PRESENT STATUS OF CONTROL WITHIN THE GROVE AREA.

During the latter part of May and early part of June, 1939, an attempt was made by the CCC insect control crew to control the 1938-1939 overwintering generations of mountain pine beetle, by felling and peeling. However, owing to the late start, a portion of the brood had already emerged and a portion was in the process of escaping. The control work at this time served in a good many instances to liberate adults and was thereby actually assisting them. In general the amount of good accomplished at that time in reducing broods is questionable. Furthermore, only a portion of the infested trees containing overwintering generations was treated. The adults in untreated trees were allowed to escape, resulting in nullification of any good accomplished by the control work.

As an example, the following table based on a 100% cruise of the Grove shows the actual volume of infested material of the 1938 overwintering generations, treated and untreated.

Table 3. Treated, Felled and Standing Infested Sugar Pines Containing 1938 Overwintering Generations

Treatment	Number trees	% of tot. trees	Volume (board feet)	% of total volume
Felled and peeled	16	35	70,520	43
Felled only	4	8	11,650	7
Left standing	26	57	81,450	50

The table indicates considerable doubt as to the value of the control work accomplished. There is in addition much question regarding the efficacy of treatment judging from observations made at the time the trees were treated. The following weaknesses are most apparent:

1. Fifty-seven percent of the infestation was left untreated. The actual amount of brood destroyed was certainly not over 43 percent and was most probably very much less.

2. Some of the treated trees were 50 percent or more abandoned at the time of treatment.

3. New adults were beginning to emerge from approximately 30 percent of the trees at the time of treatment and the control work tended definitely to assist in their more rapid escape.

4. The bark was not removed from the undersides of the bole and the broods developing there were allowed to mature and escape.

5. Since no burning was done, only broods in the larval and pupal stages were destroyed.

WIND DAMAGE AS A SOURCE OF THE CURRENT INFESTATION.

During the winter (1937-1938) severe wind storms caused considerable damage by breakage and blow downs within the Grove area. No attempt was made to control the mountain pine beetle which developed abundantly, particularly in the windfalls, resulting in a source of infestation to sound trees standing in the immediate vicinity. The figures given in Table 4 show the extent of damage to standing timber directly traceable to windfall infestations. Almost all of the broods which developed, hibernated during the winter (1938-1939) and emerged during the summer (1939) to infest standing trees with the summer generation.

Table 4. Wind Damage in Relation to Infestation.

Season	Number trees	% of tot. trees	Volume (board feet)	% of total volume
		Sugar Pines with Broken Tops		
1938 winter	9	19	6,170	4
1939 summer	5	10	8,550	5
1939 winter	1	10	290	.5
		Sugar Pines with Windfalls Nearby		
1938 winter	2	4	430	.2
1939 summer	12	25	13,960	8

These figures leave little doubt as to the advisability of cleaning up windfall infestations, for it is shown that 12 percent of the total number of trees and 8 percent of the total volume killed by summer generations were directly traceable to this source.

Trees which have had their tops broken out by wind are definitely susceptible to mountain pine beetle attacks.

MOUNTAIN PINE BEETLE POPULATIONS IN RELATION TO CONTROL

Studies of brood populations in the Grove area covering the past 3 years have shown definitely that the overwintering broods are nearly twice as abundant as the summer generation broods. For example, the average number of larvae, pupae, and adults found in 7 infested overwintering (1938-1939) trees was 110 per square foot of bark area, while the average number found in the same number of summer (1939) trees was 48 individuals per square foot. While no reasons are given here for the difference in seasonal populations, this fact is sufficient to indicate even more emphatically the importance of effective control work to be carried on during the late fall and spring months.

CONCLUSIONS AND RECOMMENDATIONS

The present status of conditions in Mariposa Grove has come about even though insect control work has been carried on. The reasons for this have been set forth in order that a better understanding may be had in combatting the situation.

In view of the circumstances as presented, recommendations for further work are emphasized, but only under the following conditions:

1. Late fall and early spring control by burning should be undertaken whenever the fire hazard is low. Control work, beginning as early as November 1 and ending as late as May 15 can reasonably be undertaken during an ordinary year.

2. Constant supervision is recommended in order that the work may be properly executed to do the greatest good. Abandoned trees are often peeled and treated when the time could be better spent on trees containing broods.

3. The apparently small benefit derived from the treatment of summer broods does not seem justified. It is therefore recommended that summer control be suspended until such time as more efficient methods are developed, except for accessible trees that can be treated at the right time. Any attempt to carry on general control to reduce summer populations is impractical.

4. Infestations which develop in windfalls should be controlled whenever they are found to contain overwintering broods.

G. R. Struble

Berkeley, California
October 18, 1939

MARIPOSA GROVE

INSECT SURVEY AND CONTROL – 1939

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38-54-56 38-57-60 39-79 38-42 39-60-64 38-61 39-80 39-65 WAWONA POINT 38-41 39-58,59 38-40 39-57 39-81 TK 39-77 39-56 38-38 38-39 39-52 39-78 TK BIG TREE LODGE 39 S 39-73 39-53 39-54 39-35 39 W 39-70 38-45 38-44 39-69 39-51 TK 39-50 38-37 38-49 38-36 38-34 39-36-38 POLES 1938 W 1938 S 38-35 38-33 39-72 39-47 39-74,75 38-49 39-76 38-50-51 38-32 39-44 39-42 38-31 38-46 38-52 38-48 39-66-68 39-71 TK 39-43 39-31,32 38-23 38-22 38-53 TK R.S. 39-19 38-10 39-38 39-18 39-17 TK 38-11 39-20 TK 39-37 39-36 TK 39-9,10 38-6 39-15 38-9 39-14 38-21 38-34 38-7 39-21 39-33,34 38-27 38-5 39-7,8 39-6 TK 39-16 39-39 38-30 38-4 39-1,2 39-12 38-8 TK 39-23-25 POLE 39-22 39-35 39-40,41 39-3 39-13 39-26 38-12 39-30 39-4,5 39-27,28 38-13 38-3 39-11 POLES 38-20 38-25, 26 38-28 38-14-19 39-29

17 16 18 19 20 21 8 9

LEGEND

× SUGAR PINE
(× TREATED)

o PONDEROSA PINE

⊙ JEFFREY PINE